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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 10/20/2003

13

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/836,674

Applicant(s)

LINDFORS, SVEN

Examiner

Matthew J Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 August 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) 27-34 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 and 35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. This application contains claims 27-34 drawn to an invention nonelected with traverse in Paper No. 8. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 1 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, "a reaction chamber having a single substrate" in line 2. There is no support in the instant specification for a "single substrate". The instant specification teaches a plurality of substrates, note pg 9, ln 25-30.

4. Claim 1 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim

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1 recites, "feeding a pulse of a first vapor reactant **exclusively** into said reaction chamber" in line 4 and "feeding a pulse of a second vapor phase reactant **exclusively** into said reaction chamber" in line 8. There is no support in the instant specification for **exclusively** feeding a reactant into the reaction chamber. The instant specification teaches the reactant gases flow into a pre-reaction space prior to the reaction chamber, note pg 10, ln 23-26, which suggests the reactants are not feed into a pre-reactor and the reactor; therefore not exclusively feed into the reaction chamber. The instant specification also teaches an inactive gas is used as the carrier gas of the vapor phase pulse of the reactants, note pg 7, ln 6-14, which suggest the reactants are feed with a carrier gas and not exclusively feed to the reactor.

5. Claim 35 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 35 recites, "unreacted reactants from the pulse of the first vapor phase reactant and the pulse of the second vapor phase reactant are sequentially fed into a second reaction chamber having a second single substrate" in lines 1-3. The instant specification does not provide support for a "second single substrate", as discussed previously regarding the single substrate above. Also, the instant specification does not provide support for sequentially feeding unreacted reactants into a second reaction chamber, note Figures 1-2

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

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The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

7. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites, "feeding a pulse of a first vapor reactant **exclusively** into said reaction chamber" in line 4 and "feeding a pulse of a second vapor phase reactant **exclusively** into said reaction chamber" in line 8. It is unclear what is "exclusive" because the reactant can "exclusively" be feed to the reactor without other intermediate devices, such as a pre-reactor or pipes, or the reactant can be "exclusively" feed to the reactor without other gases, such as carrier gases or "exclusively" can mean the reactant gases are feed from individual pipes.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1-18 and 22-25 are rejected under 35 U.S.C. 102(b) as being anticipated by Suntola et al (US 6,015,590).

Suntola et al discloses an apparatus for ALE comprising four reaction chambers 13 having substrates 12 onto which thins films are grown using the ALE process, where vapor phase reactants are feed into a reaction space in the form of vapor phase pulses repeatedly and alternately and evacuating the reaction space between successive pulses (claim 1 and col 3, ln 1-67). Suntola et al also discloses a reactant inflow channel 7 for metallic reactants such as TiCl_4 ,

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ZnCl₂, hydrogen sulfide and sulfur (col 4, ln 45-60, col 8, ln 30-67 and Fig 1). Suntola et al also teaches starting materials are isolated from each other thus preventing their pre-mature mutual reactions and such reactions occur in the gas phases resulting in a CVD thin film (col 7, ln 5-67). Suntola et al also teaches a design target of less than 1% of residual components of a preceding vapor phase reactant pulse remaining at the infeed of the next pulse and the reaction space can be purged to less than 1 ppm of reactant residues from the preceding pulse (col 5, ln 10-35 and col 3, ln 25-40). Suntola et al also discloses the "reaction space" includes the space in which the substrate is located and the gas inflow channels communicating with the reaction chamber (col 4, ln 25-50). Suntola et al also discloses a substrate is place in a reaction space (Abstract and Claim 1)

Referring to claim 1, Suntola et al discloses feeding a vapor phase pulse, purging the reactor to less than 1% of residual components and feeding in a second vapor phase pulse, as applicant. Suntola et al is silent to a reaction product is formed. This is inherent to Suntola et al because Suntola et al teaches a similar residual amount of first reactant, as applicant (note instant claim 22), and similar reactants, as applicant (note pg 7 of the instant specification); therefore a reaction product is inherently formed. The examiner interprets "exclusively" to mean the reactants are fed from individual pipes because the other possible definitions contradict applicant's invention. Suntola teaches reactant are fed into a reaction space via a separate inflow path, this reads on the definition of exclusively interpreted by the Examiner. Also, Suntola teaches "a" substrate is placed in a reaction space (Abstract and Claim 1); "a" is singular, therefore Suntola teaches a single substrate. It is also noted, Suntola teaches a conventional ALE apparatus in US 4,389,973 (col 2, ln 15-65), where US 4,389,973 teaches a single substrate.

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Therefore, ALE processes and apparatuses for single substrates are well known in the art, note Suntola (US 4,389,973) below.

Referring to claim 2, Suntola et al discloses a vapor phase reactant pulse (col 9, ln 10-20).

Referring to claim 3, Suntola et al discloses molecules adsorbed on the inner walls of the system (col 8, ln 10-17).

Referring to claim 4, Suntola et al discloses a inflow channel 7, this reads on applicant's pre-reactor, upstream from the reaction chambers 13, this reads on applicant's second reaction chamber.

Referring to claim 5-6, Suntola et al discloses an ALE process, this reads on applicant's ALD, for forming a thin film on substrates 12 placed in the reaction chambers 13.

Referring to claim 7, Suntola et al discloses the piping, this reads on applicant's pre-reactor, is evacuated such that the residual vapor phase reactant is less than 1% (col 5, ln 10-35).

Referring to claim 9, Suntola et al discloses feeding vapor phase reactants alternately (claim 1).

Referring to claim 10, Suntola et al discloses feeding a vapor phase pulse, purging the reactor to less than 1% of residual components and feeding in a second vapor phase pulse, as applicant. Suntola et al is silent to a reaction product is formed. This is inherent to Suntola et al because Suntola et al teaches a similar residual amount of first reactant, as applicant (note instant claim 22), and similar reactants, as applicant (note pg 7 of the instant specification); therefore a reaction product is inherently formed.

Referring to claim 11, Suntola et al discloses a plurality of vapor phase reactants (claim 1).

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Referring to claim 12, 16 and 28, Suntola et al discloses feeding a vapor phase pulse, purging the reactor to less than 1% of residual components and feeding in a second vapor phase pulse and the temperature of the reactor and pre-reactor are the same temperature, as applicant. Suntola et al is silent to the second vapor phase reactant reacts with the residual first vapor phase reactant under conditions conducive to chemical vapor deposition. This is inherent to Suntola et al because Suntola et al teaches a similar residual amount of first reactant, as applicant (note instant claim 22), and similar reactants, as applicant (note pg 7 of the instant specification); therefore a reaction product is inherently formed by CVD conditions.

Referring to claim 13, Suntola et al discloses the pre-reactor 7 is placed immediately adjacent the second reactor 13 (Fig 1).

Referring to claim 14, Suntola et al discloses an inflow channel 28 for starting material of group B and an inflow channel 29 for a starting material of group A (col 10, ln 1-30 and Fig 2).

Referring to claim 15, Suntola et al discloses the inflow channels and intermixing in the inflow slit, this reads on applicant's pre-reactor (col 10, ln 40-55).

Referring to claim 17, Suntola et al discloses feeding a vapor phase pulse, purging the reactor to less than 1% of residual components and feeding in a second vapor phase pulse and the temperature of the reactor and pre-reactor are the same temperature, as applicant. Suntola et al is silent to the second vapor phase reactant reacts with the residual first vapor phase reactant to form a solid product so as to deplete the residual first vapor phase reactant. This is inherent to Suntola et al because Suntola et al teaches a similar residual amount of first reactant, as applicant (note instant claim 22), and similar reactants, as applicant (note pg 7 of the instant specification); therefore a reaction product is inherently formed by CVD conditions

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Referring to claim 18, Suntola et al discloses the "reaction space" includes the reaction chamber and the inflow piping (col 4, ln 29-45); therefore the "reaction space" would inherently be operated at the same temperature for ALE deposition.

Referring to claim 22, Suntola et al discloses less than 1 ppm (col 5, ln 30-31).

Referring to claim 23, Suntola et al discloses less than 1% (col 5, ln 25-26 and Claim 1).

Referring to claim 24, Suntola et al discloses the reaction space is purged with an inactive gas during the interval between the reactant pulses (col 5, ln 10-30).

Referring to claim 25, Suntola et al discloses the reaction space is purged with an inactive gas and evacuated (col 5, ln 10-30).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 19-21 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suntola et al (US 6,015,590) in view of Soininen et al (US 5,855,680).

Suntola et al discloses all of the limitations of claim 19, as discussed previously, except the reaction product is removed from the reaction chamber separately from the thin film.

In an apparatus for growing thin films, Soininen et al teaches in an atomic layer epitaxy (ALE) method points where undesired film growth occurs must be subjected at regular intervals to surface cleaning from grown films, this reads on applicant's reaction product is removed from

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the reaction chamber separately from the thin film, or the contaminated parts must be replaced by new ones (col 8, ln 35-50). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Suntola et al with Soininen et al because cleaning reduces part replacement.

Referring to claim 20, the combination of Suntola et al and Soininen et al teaches undesired film growth occurs on other surfaces of a reaction chamber which can be replaced, this reads on applicant's discardable substrate.

Referring to claim 21, the combination of Suntola et al and Soininen et al teaches cleaning the undesired deposition.

12. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suntola et al (US 6,015,590) in view of Mochizuki et al (US 5,166,092).

Suntola et al discloses all of the limitations of claim 26, as discussed previously, except the pressure of the reaction chamber is in the range of 1 to 100 mbar.

In a method of growing a compound film by atomic layer epitaxy, note entire reference, Mochizuki et al teaches a pressure dependency of the thickness of a grown GaAs layer per material supply cycle and a satisfactory GaAs molecular layer is obtainable in a pressure range of approximately 7 Torr to 60 Torr (9.3 to 80 mbar) (col 6, ln 65 to col 7, ln 5 and Fig 10). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Suntola et al with Mochizuki et al's pressure to produce a satisfactory GaAs molecular layer.

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The combination of Suntola et al and Mochizuki et al teach a pressure range of 9.3 to 80 mbar. The combination of Suntola et al and Mochizuki et al does not teach a pressure range of 1 to 100 mbar. Overlapping ranges are held to be obvious (MPEP 2144.05).

Response to Arguments

13. Applicant's arguments filed 8/4/2003 have been fully considered but they are not persuasive.

Applicant's argument that Suntola does not teach a single substrate is noted but is not found persuasive. Applicant alleges Suntola discloses a reactor with "in-parallel stacked reaction chamber", therefore does not teach a single substrate. However, Suntola is not as limited as suggested by applicant. The passage cited by applicant is merely a preferred embodiment taught by Suntola, note col 8, ln 29-30. Suntola teaches "a" substrate is placed in a reaction space, note Claim 1 and Abstract, which reads on applicant's single substrate. Furthermore, the use of a single or a plurality of substrates in an ALE apparatus is well known in the art, note Suntola (US 4,389,973) below.

Applicant's argument regarding claim 20 has been considered but is not found persuasive. Applicant alleges Soininen teaches points where undesired film growth occurs, namely the other surfaces of the reaction pack than substrate surfaces, therefore teaches away from the reaction product is deposited on a discardable substrate. A substrate is a material on which a thin film is to be grown, as defined by applicant. The other surfaces of the reaction pack where film growth occurs reads on applicant's discardable substrate because film growth occurs on the surface of the reaction pack and these parts can be replaced, i.e. discarded.

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Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Suntola et al (US 4,389,973) teaches an apparatus of ALE comprising a reaction zone 18 and a substrate or substrates 11 place in the reaction zone (col 2, ln 5-67 and Fig 2).

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
PRIMARY EXAMINER

